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ABSTRACT

A project was undertaken to develop and implement domain-referenced tests (DRTs) for welders' helpers. After analyzing the results of a state survey of welding job titles and related tasks and after consulting with postsecondary educators and industry personnel, researchers developed DRTs to measure various tasks typically performed by welders. Included among the content areas covered in the tests were edge, butt, lap, tee, and corner joints; plug holes; carbon steel; work orders; power sources; controls; cables; properties of shielding gases; types of shielding gases and mixtures; wire electrodes; protective equipment; cleaning surfaces for welding; starting arcs; restarting arcs; cleaning welds; weld troubleshooting; testing welds; and removing weld defects. Because of time constraints, researchers were unable to field test the examinations. However, the DRTs were used as final performance tests at the end of the school year. Students using the DRTs did well on them. In addition, some students reported that they enjoyed using this type of test. Recommendations called for fully explaining the nature of the tests to those students who will be using them and for using the DRT format more frequently throughout the school year. (Copies of the DRTs are appended.) (MN)

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ED221649

FINAL REPORT

DEVELOPMENT AND IMPLEMENTATION OF DOMAIN REFERENCE TESTING IN VOCATIONAL WELDING

Dan Sterrett

Project No. 20-80-III-3

BLUE RIVER VOCATIONAL-TECHNICAL CENTER

SHELBYVILLE, INDIANA

July 14, 1981

State Board of
Vocational and Technical Education
401 Illinois Building
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Indianapolis, Indiana 46204

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CE030669

Project population

Groups	Numbers of persons: Impacted by project	Conducting or giving input
students		
secondary	27	
postsecondary		
adult		
school personnel		
secondary		1
postsecondary		
adult		
other		
teacher educators		
employers		
employees		
other:_____		
special needs		
disadvantaged		
handicapped		
migrant		
minority		
limited English proficiency		
other:_____		

STATEMENT OF OBJECTIVES

The original objectives in the proposal contract were;

1. Develop Domain Reference Tests for Welder's helper.
2. Implement Domain Reference Tests.

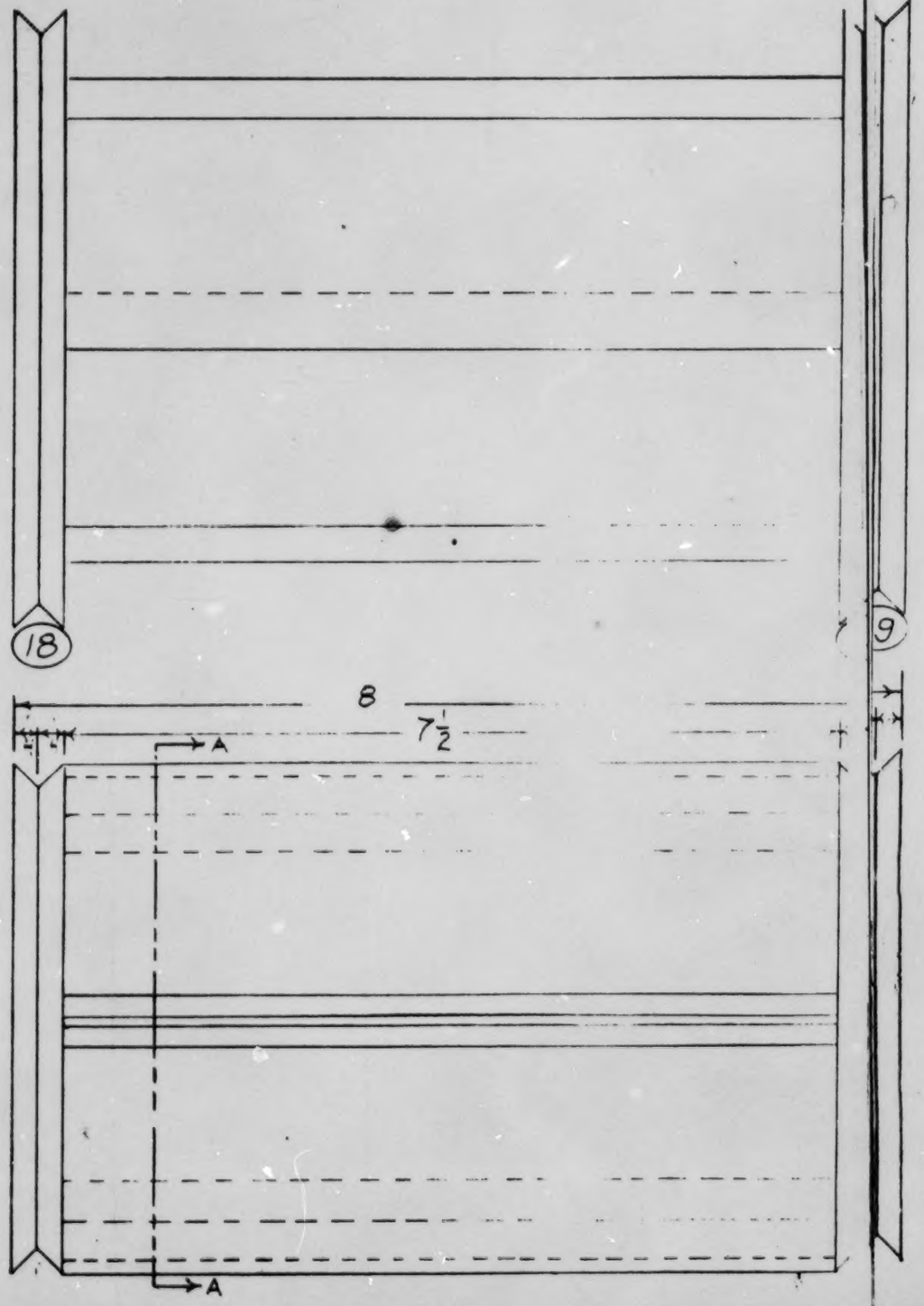
At the time the proposal was written, the domains had not been decided upon. Because of this fact, some preliminary work had to be done. When the domains were discovered the objectives were amended to;

1. Develop and implement DRT for domain Shielded Metal Arc Welding on carbon steel.
2. Develop and implement DRT for domain Gas Metal Arc Welding on carbon steel.

STATEMENT OF PROBLEM/PURPOSE

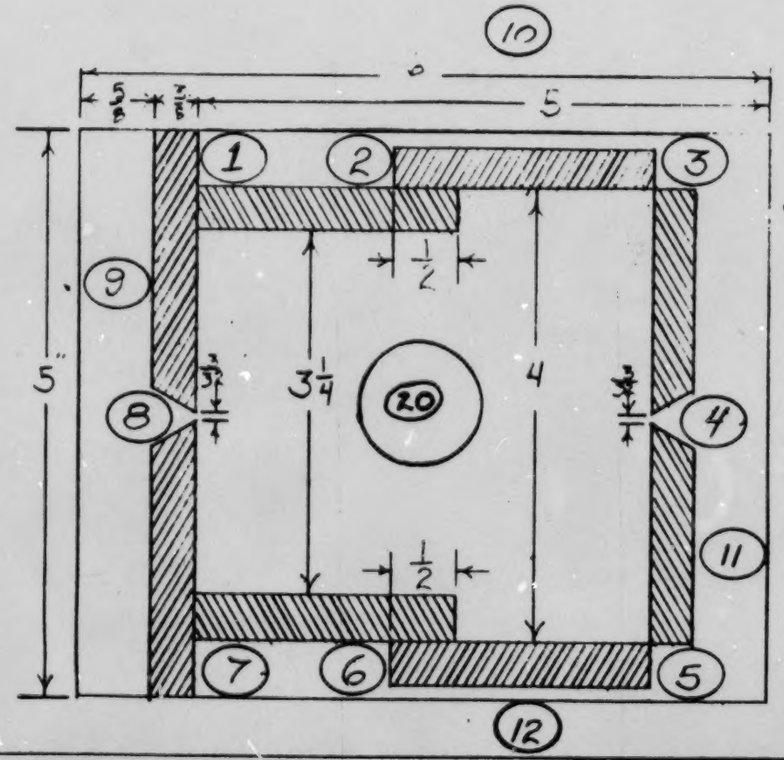
In the past, in welding a student could go through the program and learn a little bit about a lot of things. With Domain Reference Testing, the student will know how well he/she has learned a particular domain before moving into the next one.

The purpose is to test a student at the end of a domain and see what particular tasks the student is weak in. At that point, more work can be done to bring the skill level up to competency and then retest the student.



PART NAME: PRESSURE UNIT
SCALE: 3/4" = 1"
DRT #1

NOTE: COUPLING MAY BE PLACED AT WELDER'S CHOICE



OTHER END-
JOINTS-13-14-15-16

SECTION-"A.A"

Domain: GMAW Carbon Steel

1. GMAW Tee joint
2. FCAW Tee joint
3. GMAW Edge joint
4. FCAW Edge joint
5. GMAW Corner joint
6. FCAW Corner joint
7. GMAW Butt joint
8. FCAW Butt joint
9. GMAW Lap joint
10. FCAW Lap joint
11. GMAW Plug holes

CONCLUSIONS AND RECOMMENDATIONS

This project's completion was accomplished by the following procedures.

1A. Some work was done in conjunction with Dr. West and committee. However, at a later time Dr. West was removed from the picture and Nancy Evans took over who was a great help.

B. After much waiting there was finally some results from the state survey to analyze. This was a vital step in that it told us what were the job titles in industry. Knowing this makes it easier to train people for the job market.

C. Once the common job titles were known and which company submitted them, these people were visited and interviewed to learn what tasks were done under what job title.

D. Tests were Developed at this time to cover each skill. However, at a later point in time these tests were thrown out and new ones developed because the first series was not right.

E. Due to the time element there was not sufficient time to do any field testing. A further explanation can be found in Section 2B.

2A. The introduction and explanation was short, to the point and on the spot. This was done again because of the short time element.

B. The administering of the DRT's coincided almost perfectly with the end of the school year and final time. Up until about a month before school was to end progress on the project was very slow. Once things started falling in place it was very easy to see what needed to be done. With the short amount of time left in school there really wouldn't be enough time to field-test and then turn around and use the tests for real after modification. The DRT's were developed in such a way that they could be used as final performance tests. After the way the domains broke out-process-material-what could be better than testing students with one test on Shielded Metal Arc Welding on carbon steel that would cover all four positions, five different types of electrodes and all five basic joint types.

C. The students performed quite well using DRT's. This was the first time they really had a chance to use everything they had learned all year long. It gave them a chance to use Blue print reading, layout, fitup, tacking and welding. After taking the tests some students reported they really enjoyed this type of test.

D. About the only adjustment that needs to be made is to let the students in on this at the beginning of the school year and then use DRT's totally or not at all.

EVALUATION

The evaluation system for these DRT's was totally subjective based on a point system. Had time allowed, any student that fell below a certain percentage would have come back and worked on that specific task and been retested.

STRATEGIES AND PROCEDURES

The procedures as stated in the proposal were two in number;

1. Work in conjunction with Dr. William West and committee. Analyze state survey of job titles and related tasks. Consult with post secondary educators and industry personnel. Develop tests to measure each skill. Field test with sample of vocational students.
2. Introduce and explain DRT's to welding students. Administer DRT's. Evaluate student performance on DRT's Make needed adjustments to DRT program.

The objectives in the proposal were;

1. Develop domain reference tests for welder's helper.
2. Implement domain reference tests.

Objective number one was modified a bit in order to allow the project to flow smoother. Originally, before the domains had even been determined, it was assumed domains would encompass job titles. Through the committee's effort and Nancy Evan's guidance, who replaced Dr. William West, it was decided to break the domains out as process and material. Therefore, objective number one reads as follows; develop domain reference tests for domains Gas Metal Arc Welding - carbon steel and Shielded Metal Arc Welding - carbon steel. After this was completed, it was merely a matter of administering the tests. Hence, objective number two stayed in its original form.

Recommendations

In order for this project to go more smoothly students should have a very good understanding of domain reference testing.

If we go back to one of the original intents of performance based education, to shorten training time - give the student enough training to get him into the job market, then DRT's should be used more often. Take for example, the student who comes into class to learn one specific amount of welding because he has a chance for a job doing this type welding. The student is in a bit of a hurry because the job will be closed in three months. GMAW - carbon steel is what he wants to learn. It just so happens that that is a domain, can be taught with eleven tasks and tested with one DRT at the end of the training period.

The most logical recommendation is to allow students to use open entry - open exit when it comes to vocational training and not worry about "administrative breaks" such as six weeks, nine weeks and semesters.

Content Limits Data Sheet A

Gas Metal Arc Welding (GMAW) Carbon Steel Domain

Section I : EDGE JOINT

A. Metal Thickness
   1. 3/16" or less
   2. 3/16" or more

B. Aligning
   1. tacking
   2. fixturing
      a. clamping
      b. positioners
      c. vise

C. Types of Edge Joints
   1. leaf
   2. flanged

Section II : BUTT JOINT

A. Metal Thickness
   1. 3/16" or less
   2. 3/16" or more

B. Aligning
   1. tacking
   2. fixturing
      a. clamping
      b. positioners
      c. vise

C. Types of Butt Joints
   1. closed single flanged
   2. open single flanged
   3. closed double flanged
   4. open double flanged
   5. closed upset
   6. open upset
   7. closed square
   8. open square
   9. closed single-V
   10. open single-V
   11. closed double-V
   12. open double-V
   13. closed single bevel
   14. open single bevel
   15. closed double bevel
   16. open double bevel
   17. closed single-U
   18. open single-U
   19. closed double-U
   20. open double-U
   21. strapped closed square
   22. strapped open square

Section II : cont.

23. strapped closed single-V
24. strapped open single-V
25. strapped closed single-U
26. strapped open single-U

D. Penetration
   1. full
   2. none

E. Key hole effect
   1. proper root opening
   2. proper electrode speed
   3. proper arc length

F. Back grinding

G. Back gouging

H. Testing methods after back grinding
   1. spot check (dye penetrant)
   2. zyglo

I. Backing Materials
   1. metal strips
   2. backing tape
      a. ceramic
      b. asbestos
   3. copper
   4. fireclay
   5. plastic

J. Butt Joint Tests
   1. guided bend tests (face & root bends)
   2. tensile tests
   3. side bend tests
   4. free bend tests

Section III : LAP JOINT

A. Metal thickness
   1. 3/16 or less
   2. 3/16 or more

B. Aligning
   1. tacking
   2. fixturing
      a. clamping
      b. positioners
      c. vise

C. Types of Lap Joints
   1. single lap
   2. double lap
   3. single strap
   4. double strap
   5. closed joggled single
   6. open joggled single

Section III : LAP JOINT (cont.)

7. flanged single
8. flanged closed joggled single
9. flanged open joggled single
10. linear slotted
11. circular slotted

Section IV : TEE JOINT

A. Metal thickness
   1. 3/16" or less
   2. 3/16" or more

B. Aligning
   1. tacking
   2. fixturing
      a. clamping
      b. positioners
      c. vise

C. Types of Tee Joints
   1. closed square
   2. open square
   3. closed single bevel
   4. open single bevel
   5. closed double bevel
   6. open double bevel
   7. closed single-J
   8. open single-J
   9. closed double-J
   10. open double-J

D. Welds used
   1. fillet
   2. multipass

E. Fillet weld parts
   1. face
   2. throat
   3. leg
   4. toe
   5. root
   6. root penetration

F. Fillet weld defects
   1. insufficient throat
   2. excessive convexity
   3. undercut
   4. overlap
   5. insufficient leg
   6. poor penetration & fusion

Section V : CORNER JOINT

A. Metal thickness
   1. 3/16" or less
   2. 3/16" or more

B. Aligning
   1. tacking
   2. fixturing
      a. clamping
      b. positioners
      c. vise

C. Types of Corner Joints
   1. closed lapped
   2. open lapped
   3. closed
   4. open

Section VI : PLUG HOLES

A. Backing material
   1. Copper
   2. Ceramic
   3. Metal

Content Limits Data Sheet B

Gas Metal Arc Welding (GMAW) Carbon Steel Domain

Section I : CARBON STEEL

A) High Carbon
B) Medium Carbon
C) Low Carbon
D) Tool Steel

Section II : WORK ORDER

A) Job Print
B) Verbal Order

Section III : POWER SOURCE

A) Transformer-Rectifier
B) Motor Generator
   1) Electric
   2) Gas Drive

Section IV : CONTROLS

A) Amperage
   1. Wire speed
B) Voltage
   1. Arc length
C) Inductance
D) Shielding gas
E) Coolant flow
   1. Water
   2. Air

Section V : CABLES

A) Gun
B) Ground

Section VI : PROPERTIES OF SHIELDING GASES

A) Thermal Properties at Elevated Temperatures
B) Chemical Reactions of the Gas With the Various Elements in the Workpiece and Wire.
C) Effect of Each Gas on the Mode of Metal Transfer

Section VII : TYPES OF SHIELDING GASES AND MIXTURES

A) Argon
   1. 98% AR-2% O_2
   2. 95% AR-5% O_2

Section VII : TYPES OF SHIELDING GASES AND MIXTURES (CONT.)

B) CO_2
   1. AR-3%-10% CO_2
   2. AR-8% CO_2
   3. AR-25% CO_2
   4. AR-50% CO_2

C) Triple Mix
   1. 90% AR-8% CO_2-2% O_2

Section VIII: WIRE ELECTRODES

A) Classifications
   1) Solid Wire
      a) E705-1
      b) E705-2
      c) E705-3
      d) E705-4
      e) E705-5
      f) E705-6
      g) E705-G
      h) E705-1B
   2) Flux-Cored Wire
      a) E60T-7
      b) E60T-8
      c) E70T-1
      d) E70T-2
      e) E70T-3
      f) E70T-4
      g) E70T-5
      h) E70T-6
      i) E70T-G

B) Sizes
   1. Solid Wire
      a) .020-1/8" D.
   2. Flux-Cored Wire
      a) 1/16"-5/32" D.

Section IX : PROTECTIVE EQUIPMENT

A) Welding helmet
B) Safety glasses
C) Welding gloves
D) Long sleeved shirt
E) High top leather workboots
F) Leather sleeves
G) Leather jacket
H) Leather pants
I) Leather spats
J) Leather apron
K) Duck sleeves
L) Duck jacket
M) Duck pants
N) Duck spats
O) duck apron

Section X : CLEAN SURFACE FOR WELDING

A) Acid etch
B) Grind
C) Brush
D) Sandblast

Section XI : STARTING ARC

A. Proper gun angle
   1. Travel angle
   2. Work angle
B. Work distances
   1. Tip-to-work
   2. Wire extension (stickout)
   3. Arc length

Section XII : RESTART

A. Run out of wire
B. Welder out of position
C. Part out of position

Section XIII: CLEAN WELD

A. Wire brush
B. Hammer & chisel

Section XIV : WELD TROUBLESHOOTING

A) Porosity
B) Lack of penetration
C) Lask of fusion
D) Undercutting
E) Cracking
F) Unstable Arc
G) Poor weld starts or wire stubbing
H) Excessive spatter
I) Burn through
J) Convex Bead

Section XV : TESTING

A) NDT
B) DT

Section XVI : REMOVAL OF WELD DEFECTS

A) Grinding
B) Chipping
C) Arc air gouge
D) Cutting

Section XVII: WORK ORDER

A) Verbal
B) Written

TASK ANALYSIS GUIDE

I. Task Statement: **GMAW-Carbon Steel-Tee Joint**

II. Task Performance Cues: **Work Order**

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a Verbal Order?	2	17		
2. Set up GMAW Equipment.			3	
3. Select Proper filler wire.			4	
4. Put on Welding gear.			5	
5. Will parts be tacked?	6	18		
6. Clean and position parts.			7	
7. Secure parts.			8	
8. Are parts properly aligned?	9	22		
9. Begin welding parts together.			10	
10. Burn into root for penetration.			11	
11. Is proper bead contour and size forming?	12	19		
12. Is there any undercut?	23	13		
13. Complete weld.			14	
14. Visually inspect weld.			15	
15. Are there any surface cracks?	20	16		
16. Shut down equipment.			EOT	
17. Read work order.			2	
18. Position and secure parts.			6	
19. Check welding parameters.			11	
20. Grind out cracks.			21	
21. Reweld.			11	
22. Realign parts for fitup.			8	
23. Run another bead to fill undercut.			12	

Domain: GMAW - Tee Joint - Carbon Steel

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #1 T. E. 1, 5, 7, 8, 17, 18, 22 Size Up Job . Work Order . Job Print . Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel . Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Tee Joint Types a) closed square b) open square c) closed single bevel d) open single bevel e) closed double bevel f) open double bevel g) closed single-J h) open single-J i) closed double-J j) open double-J 2. Welds used a) fillet b) multi-pass 3. Metal thickness a. 3/16" or less b. over 3/16" 4. Tacking 5. Fixturing	1. Respond to Work Order. 2. Position Parts.	
Subtask #2 T. E. 2, 16, 19 Set up Welding Station .. Power Source A. Transformer-Rectifier B. Motor-Generator I) Electric II) Gas Drive . Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Shielding Gas E. Coolant Flow		1. Set up Station. 2. Adjust Machine.	

:itive Knowledge Generaliza- a to ALL Tasks in the Domain	Cognitive Knowledge Genera.- izable to a CLASS of Tasks	Psychomotor Sk: lls Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
ɔcask #2 (Cont.) Cables A. Ground B. Gun Properties of Shielding Gas Types of Shielding Gas A. Argon B. Helium C. CO_2			
ıbtast #3 . E. 3, 4, 6 etting Ready To Weld . Wire Electrodes A. Types B. Sizes . Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons		1. Select proper type & size of wire. 2. Put on protective equip- ment.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
btask #3 (cont.)			
Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand blast		3. Clean surface.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #4 T. E. 9, 10, 11, 13, 21, 23 Weld Parts 1. Starting Arc A. Gun angle B. Wire stickout 2. Bead formation A. Too high B. Too low C. Too wide D. Too Narrow 3. Restart A. Run out of wire B. Welder out of position C. Part out of position 4. Clean Weld A. Wire brush B. Hammer & chisel 5. Root penetration		1. Pull trigger to start wire. 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Ship spatter with chisel.	
Subtask #5 T. E. 12, 14, 15, 20 Inspection and Testing 1. Weld troubleshooting 2. Testing 3. Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting	1. Fillet weld parts a) face b) throat c) leg d) toe e) root f) root penetration 2. Fillet weld defects a) insufficient throat b) excessive convexity c) undercut d) overlap e) insufficient leg f) poor penetration & fusion		Correct Weld Defects.

TASK ANALYSIS GUIDE

I. Task Statement: FCAW-Carbon Steel-Tee Joint

II. Task Performance Cues: Work Order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	18		
2. Set up FCAW equipment.			3	
3. Select proper filler metal.			4	
4. Put on welding gear.			5	
5. Will parts be tacked?	6	19		
6. Clean and position parts.			7	
7. Secure parts.			8	
8. Are parts properly aligned?	9	23		
9. Begin welding parts together.			10	
10. Burn into root for penetration.			11	
11. Is proper bead contour and size forming?	12	20		
12. Is there any undercut?	24	13		
13. Complete weld.			14	
14. Chip slag.			15	
15. Visually inspect weld.			16	
16. Are there any surface cracks?	21	17		
17. Shut down equipment.			EOT	
18. Read workorder.			2	
19. Position and secure parts.			6	
20. Check welding parameters.			11	
21. Grind out cracks.			22	
22. Reweld the joint.			11	
23. Realign parts for fitup.			8	
24. Run another bead to fill undercut.			12	

Domain: FCAW - Tee Joint - Carbon Steel

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #1 T. E. 1, 5, 7, 8, 18, 19, 23 Size Up Job 1. Work Order 2. Job Print 3. Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel 4. Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Tee Joint Types a) closed square b) open square c) closed single bevel d) open single bevel e) closed double bevel f) open double bevel g) closed single-J h) open single-J i) closed double-J j) open double-J 2. Welds used a) fillet b) multi-pass 3. Metal thickness a. 3/16" or less b. over 3/16" 4. Tacking 5. Fixturing	1. Respond to Work Order. 2. Position Parts.	
Subtask #2 T. E. 2, 17, 20 Set up Welding Station 1. Power Source A. Transformer-Rectifier B. Motor-Generator I) Electric II) Gas Drive 2. Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Shielding Gas E. Coolant Flow		1. Set up Station. 2. Adjust Machine.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #2 (Cont.) . Cables A. Ground B. Gun .. Properties of Shielding Gas 3. Types of Shielding Gas A. Argon B. Helium C. CO_2			
Subtast #3 T. E. 3, 4, 6 <u>Getting Ready To Weld</u> 1. Wire Electrodes A. Types B. Sizes 2. Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons		1. Select proper type & size of wire. 2. Put on protective equipment.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #3 (cont.)			
3. Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand blast		3. Clean surface.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #4 T. E. 9, 10, 11, 13, 14, 22, 24 Weld Parts 1. Starting Arc A. Gun angle B. Wire stickout 2. Bead formation A. Too high B. Too low C. Too wide D. Too Narrow 3. Restart A. Run out of wire B. Welder out of position C. Part out of position 4. Clean Weld A. Wire brush B. Hammer & chisel 5. Root penetration		1. Pull trigger to start wire. 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Ship spatter with chisel.	
Subtask #5 T. E. 12, 15, 16, 21 Inspection and Testing 1. Weld troubleshooting 2. Testing 3. Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting	1. Fillet weld parts a) face b) throat c) leg d) toe e) root f) root penetration 2. Fillet weld defects a) insufficient throat b) excessive convexity c) undercut d) overlap e) insufficient leg f) poor penetration & fusion		Correct Weld Defects.

TASK ANALYSIS GUIDE

I. Task Statement: GMAW-CARBON STEEL-EDGE JOINT

II. Task Performance Cues: Work order.

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	18		
2. Is metal to be welded under 3/16"?	3	19		
3. Set up FCAW equipment.			4	
4. Select filler metal.			5	
5. Put on welding gear.			6	
6. Will parts be tacked?	7	19		
7. Clean and position parts.			8	
8. Secure parts.			9	
9. Are parts properly aligned?	11	23		
10. Burn into root for penetration.			12	
11. Begin welding parts together.			10	
12. Is proper bead contour and size forming?	13	20		
13. Complete weld.			14	
14. Visually inspect weld.			15	
15. Are there excessive surface cracks?	21	16		
16. Shut down equipment.			EOT	
17. Read work order.			2	
18. Prepare edges for welding.			3	
19. Position and secure parts for welding.			7	
20. Check welding parameters.			12	
21. Grind out cracks.			22	
22. Rewold.			14	
23. Realign parts for fitup.			9	

Domain: GMAW - EDGE JOINT - Carbon Steel

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #1 T.E. 1, 2, 6, 8, 9, 17, 19, 23 Size up Job 1. Work Order 2. Job Print 3. Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel 4. Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Edge joint types A) Leaf B) Flanged 2. Metal thickness A) 3/16" or less B) over 3/16" 3. Tacking 4. Fixturing	1. Respond To Work Order. 2. Position Parts.	
Subtask #2 T. E. 5, 16, 20 Set Up Welding Station 1. Power Source A. Transformer-Rectifier B. Motor-Generator I) Electric II) Gas Drive 2. Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Shielding Gas E. Coolant Flow 3. Cables A. Ground B. Gun		1. Set up Station. 2. Adjust Machine.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #2 (Cont.) 4. Properties of Shielding Gas 5. Types of Shielding Gas A. Argon B. Helium C. CO_2			
Subtask #3 T. Ex. 5, 7, 18 Getting Ready To Weld 1. Wire Electrodes A. Types B. Sizes 2. Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons 3. Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand blast		1. Select proper type & size of wire. 2. Put on protective equipment. 3. Clean surface.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #4 T. E. 10, 11, 12, 13, 22 Weld Parts 1. Starting Arc A. Gun angle B. Wire stickout 2. Bead formation A. Too high B. Too low C. Too wide D. Too Narrow 3. Restart A. Run out of wire B. Welder out of position C. Part out of position 4. Clean Weld A. Wire brush B. Hammer & chisel 5. Root penetration		1. Pull trigger to start wire. 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Ship spatter with chisel.	1. Weld Edge Joint.
Subtask #5 T. E. 14, 15, 21 Inspection and Testing 1. Weld troubleshooting 2. Testing 3. Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting			

TASK ANALYSIS GUIDE

I. Task Statement: FCAW-CARBON STEEL-EDGE JOINT

II. Task Performance Cues: Work order.

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	18		
2. Is metal to be welded under 3/16"?	3	19		
3. Set up FCAW equipment.			4	
4. Select filler metal.			5	
5. Put on welding gear.			6	
6. Will parts be tacked?	7	20		
7. Clean and position parts.			8	
8. Secure parts.			9	
9. Are parts properly aligned?	11	24		
10. Burn into root for penetration.			12	
11. Begin welding parts together.			10	
12. Is proper bead contour and size forming?	13	21		
13. Complete weld.			14	
14. Chip slag from weld.			15	
15. Visually inspect weld.			16	
16. Are there excessive surface cracks?	22	17		
17. Shut down equipment.			EOT	
18. Read work order.			2	
19. Prepare edges for welding.			3	
20. Position and secure part for welding.			7	
21. Check welding parameters.			12	
22. Chip arc cracks.			23	
23. Reweld.			15	
24. Realign parts for fitup.			9	

Domain: FCAW - Edge Joint - Carbon Steel

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #1 T.E. 1,2,6,8,9,17,19,23 Size up Job 1. Work Order 2. Job Print 3. Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel 4. Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Edge joint types A) Leaf B) Flanged 2. Metal thickness A) 3/16" or less B) over 3/16" 3. Tacking 4. Fixturing	1. Respond To Work Order. 2. Position Parts.	
Subtask #2 T. E. 3, 17, 21 Set Up Welding Station 1. Power Source A. Transformer-Rectifier B. Motor-Generator I) Electric II) Gas Drive 2. Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Shielding Gas E. Coolant Flow 3. Cables A. Ground B. Gun		1. Set up Station. 2. Adjust Machine.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #2 (Cont.) 4. Properties of Shielding Gas 5. Types of Shielding Gas A. Argon B. Helium C. CO_2			
Subtask #3 **T. E4, 5, 7, 19** **Getting Ready To Weld** **1. Wire Electrodes** **A. Types** **B. Sizes** **2. Protective equipment** **A. Welding helmet** **B. Safety glasses** **C. Welding gloves** **D. Long sleeved shirt** **E. Leather high top boots** **F. Leather sleeves** **G. Leather jackets** **H. Leather pants** **I. Spats** **J. Duck sleeves** **K. Duck jackets** **L. Duck pants** **M. Duck aprons** **N. Leather aprons** **3. Clean surface to be welded.** **A. Acid etch** **B. Grind** **C. Brush** **D. Sand blast**		**1. Select proper type & size of wire.** **2. Put on protective equipment.** **3. Clean surface.**	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #4 T. E. 10,11,12,13,14,23 Weld Parts 1. Starting Arc A. Gun angle B. Wire stickout 2. Bead formation A. Too high B. Too low C. Too wide D. Too Narrow 3. Restart A. Run out of wire B. Welder out of position C. Part out of position 4. Clean Weld A. Wire brush B. Hammer & chisel 5. Root penetration		1. Pull trigger to start wire. 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Ship spatter with chisel.	1. Weld Edge Joint.
Subtask #5 T. E. 15, 16, 22 Inspection and Testing 1. Weld troubleshooting 2. Testing 3. Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting			

TASK ANALYSIS GUIDE

I. Task Statement: GMAW-CARBON STEEL-CORNER JOINT

II. Task Performance Cues: Work Order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	17		
2. Is metal to be welded under 3/16"?	3	18		
3. Set up GMAW equipment.			4	
4. Select filler metal.			5	
5. Put on welding gear.			6	
6. Will parts be tacked?	7	19		
7. Clean and position parts.			8	
8. Secure parts.			9	
9. Are parts properly aligned?	11	23		
10. Burn into root for penetration.			12	
11. Begin welding parts together.			10	
12. Is proper bead contour and size forming?	13	20		
13. Complete weld.			14	
14. Visually inspect weld.			15	
15. Are there excessive surface cracks?	21	16		
16. Shut down equipment.			EOT	
17. Read work order.			2	
18. Prepare edges for welding.			3	
19. Position and secure parts for welding.			7	
20. Check welding parameters.			12	
21. Grind out cracks.			22	
22. Rebuild [illegible]			14	
23. Realign parts for fitup.			9	

Domain: GMAW - CORNER JOINT - Carbon Steel

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #1 T.E. 1, 2, 6, 8, 9,17, 19, 23 Size up Job 1. Work Order 2. Job Print 3. Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel 4. Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Corner Joint Types a) closed lapped b) open lapped c) closed d) open 2. Metal thickness a) 3/16" or less b) over 3/16" 3. Tacking 4. Fixturing	1. Respond To Work Order. 2. Position Parts.	
Subtask #2 T. E. 3, 16, 20 Set Up Welding Station 1. Power Source A. Transformer-Rectifier B. Motor-Generator I) Electric II) Gas Drive 2. Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Shielding Gas E. Coolant Flow 3. Cables A. Ground B. Gun		1. Set up Station. 2. Adjust Machine.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #2 (Cont.) 4. Properties of Shielding Gas 5. Types of Shielding Gas A. Argon B. Helium C. CO_2			
Subtask #3 T. E. 4, 5, 7, 18 Getting Ready To Weld 1. Wire Electrodes A. Types B. Sizes 2. Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons 3. Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand blast		1. Select proper type & size of wire. 2. Put on protective equipment. 3. Clean surface.	Align parts for corner joint.

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #4 T. E. 10,11,12, 13,22 Weld Parts 1. Starting Arc A. Gun angle B. Wire stickout 2. Bead formation A. Too high B. Too low C. Too wide D. Too Narrow 3. Restart A. Run out of wire B. Welder out of position C. Part out of position Clean Weld A. Wire brush B. Hammer & chisel 5. Root penetration		1. Pull trigger to start wire. 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Ship spatter with chisel.	1. Weld Corner Joint.
Subtask #5 T. E. 14, 15, 21 Inspection and Testing 1. Weld troubleshooting 2. Testing 3. Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting			

TV 6

TASK ANALYSIS GUIDE

I. Task Statement: FCAW-CARBON STEEL-CORNER JOINT

II. Task Performance Cues: Work Order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	18		
2. Is metal to be welded under 3/16"?	3	19		
3. Set up FCAW equipment.			4	
4. Select filler meta.			5	
5. Put on welding gear.			6	
6. Will parts be tacked?	7	20		
7. Clean and position parts.			8	
8. Secure parts.			9	
9. Are parts properly aligned?	11	24		
10. Burn into root for penetration.			12	
11. Begin welding parts together.			10	
12. Is proper bead contour and size forming?	13	21		
13. Complete weld.			14	
14. Chip slag from weld.			15	
15. Visually inspect weld.			16	
16. Are there excessive surface cracks?	22	17		
17. Shut down equipment.			EOT	
18. Read work order.			2	
19. Prepare edges for welding.			3	
20. Position and secure part for welding.			7	
21. Check welding parameters.			12	
22. Grind out cracks.			23	
23. [illegible]			15	
24. Realign parts for fitup.			9	

Domain: FCAW - CORNER JOINT - Carbon Steel

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #1 T.E. 1, 2, 6, 8, 9, 18, 20, 24 Size up Job 1. Work Order 2. Job Print 3. Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel 4. Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Corner Joint Types a) closed lapped b) open lapped c) closed d) open 2. Metal thickness a) 3/16" or less b) over 3/16" 3. Tacking 4. Fixturing	1. Respond To Work Order. 2. Position Parts.	
Subtask #2 T. E. 3, 17, 21 Set Up Welding Station 1. Power Source A. Transformer-Rectifier B. Motor-Generator I) Electric II) Gas Drive 2. Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Shielding Gas E. Coolant Flow 3. Cables A. Ground B. Gun		1. Set up Station. 2. Adjust Machine.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #2 (Cont.) 4. Properties of Shielding Gas 5. Types of Shielding Gas A. Argon B. Helium C. CO_2			
Subtask #3 T. E. 4, 5, 7, 19 <u>Getting Ready To Weld</u> 1. Wire Electrodes A. Types B. Sizes 2. Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons 3. Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand blast		1. Select proper type & size of wire. 2. Put on protective equipment. 3. Clean surface.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #4 T. E. 10, 11, 12, 13, 14, 23 Weld Parts 1. Starting Arc A. Gun angle B. Wire stickout 2. Bead formation A. Too high B. Too low C. Too wide D. Too Narrow 3. Restart A. Run out of wire B. Welder out of posftion C. Part out of position 4. Clean Weld A. Wire brush B. Hammer & chisel 5. Root penetration		1. Pull trigger to start wire. 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Ship spatter with chisel.	1. Weld Corner Joint.
Subtask #5 T. E. 15, 16, 22 Inspection and Testing 1. Weld troubleshooting 2. Testing 3. Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting			

TASK ANALYSIS GUIDE

I. Task Statement: GMAW-CARBON STEEL-BUTT JOINT

II. Task Performance Cues: Work Order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	19		
2. Is metal to be welded under 3/16"?	3	20		
3. Set up GMAW equipment.			4	
4. Select filler metal.			5	
5. Put on welding gear.			6	
6. Will parts be tacked?	7	21		
7. Clean and position parts			8	
8. Secure parts.			9	
9. Are parts properly aligned?	10	25		
10. Will backing strip be used?	27	11		
11. Begin welding parts together.			12	
12. Burn into root for complete penetration.			13	
13. Keyhole the puddle.			14	
14. Is proper bead contour and size forming?	15	22		
15. Complete the weld.			16	
16. Visually inspect the weld.			17	
17. Are there excessive surface cracks?	23	18		
18. Shut down equipment.			EOT	
19. Read work order.			2	
20. Prepare edges for welding.			3	
21. [illegible]			7	
22. [illegible]			14	
23. [illegible]			24	
24. Reveal.			17	
25. Realign parts for welding.			9	
26. Place backing strip in proper place.			11	

...itive Knowledge Generaliza- ...to ALL Tasks in the Domain	Cognitive Knowledge Generali- zable to a CLASS of Tasks	Psychomotor Skills Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
...btask #1 ...E. 1,2,6,9,10,19,20,21,25,26 ...ze up Job			
. Work Order . Job Print . Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel . Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Butt Joint Types A. Closed single flanged B. Open single flanged C. Closed double flanged D. Open double flanged E. Closed upset flanged F. Open upset flanged G. Closed square H. Open square I. Closed single-V J. Open single-V K. Closed double-V L. Open double-V M. Closed single bevel N. Open single bevel O. Closed double bevel P. Open double bevel Q. Closed single-U R. Open single-U S. Closed doube-U T. Open double-U U. Strapped closed square V. Strapped open square W. Strapped closed single-V X. Strapped open single-V Y. Strapped closed single-U Z. Strapped open single-U 2. Metal thickness A. 3/16" or less B. over 3/16" 3. Tacking 4. Fixturing	1. Respond to Work Order. 2. Position Parts.	

:itive Knowledge Generaliza- to ALL Tasks in the Domain	Cognitive Knowledge Generali- izable to a CLASS of Tasks	Psychomotor Skills Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
:btask #2 E. 3, 18, 21 : up Welding Station Power Source A. Transformer-Rectifier B. Motor Generator I) Electric II) Gas Drive Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Coolant Flow . Cables A. Ground B. Gun . Properties of Shielding Gas . Types of Shielding Gas A. Argon B. Helium C. CO_2		1. Set up Station. 2. Adjust Machine.	
ubtask #3 . E. 4, 5, 7 etting Ready To Weld . Wire Electrodes A. Types B. Sizes . Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves		1. Select proper type & size of wire. 2. Put on protective equip- ment.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
btask #3 Cont. G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand Blast		3. Clean surface.	
btask #4 E. 11, 12, 13, 14, 22, 24 eld Parts Starting Arc A. Gun angle B. Wire stickout Bead formation A. Too High B. Too low C. Too wide D. Too narrow Restart A. Run out of wire B. Welder out of position C. Part out of position Clean weld A. Wire brush B. Hammer & chisel Root penetration	1. Full root penetration 2. Key hole effect 3. Back grinding 4. Arc Air gouging 5. Backing materials A. Metal strips B. Backup tape I) ceramic II) asbestos C. copper D. Fireclay E. Plastic 6. Testing methods after backgrinding A. Spot check B. Zyglo	1. Pull trigger to start wire 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Ship spatter with chisel.	1. Weld Butt Joint. 2. Apply backing material. 3. Back grind weld. 4. Back gouge weld. 5. Test back weld with dye penetrant.

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
task #5 E. 15, 16, 17, 23 spection & Testing			
Weld troubleshooting Testing Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting	1. Guided bent test weld strip 2. Tensile test weld specimen.		1. Run plate test. 2. Bend test strips. 3. Pull test specimens.

TASK ANALYSIS GUIDE

I. Task Statement: FCAW-CARBON STEEL-BUTT JOINT

II. Task Performance Cues: Work Order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	20		
2. Is metal to be welded under 3/16"?	3	21		
3. Set up FCAW euipment.			4	
4. Select filler metal.			5	
5. Put on welding gear.			6	
6. Will parts be tacked?	7	22		
7. Clean and position parts.			8	
8. Secure parts.			9	
9. Are parts properly aligned?	10	26		
10. Will backing strip be used?	27	11		
11. Begin welding parts together.			12	
12. Burn into root for complete penetration.			13	
13. Keyhole the puddle.			14	
14. Is proper bead contour and size forming?	15	23		
15. Complete the weld.			16	
16. Chip slag.			17	
17. Visually inspect weld.			18	
18. Are ther excessive surface cracks?	24	19		
19. Shut down equipment.			EOT	
20. Read work order.			2	
21. Prepare edges for welding.			3	
22. Position and secure parts for welding.			7	
23. Check welding parameters.			14	
24. Grind out cracks.			25	
25. Reweld.			16	
26. Realign parts for welding.			9	
27. Place backing strip in proper place.			11	

. itive Knowledge Generaliza- a to ALL Tasks in the Domain	Cognitive Knowledge Generali- izable to a CLASS of Tasks	Psychomotor Skills Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
btask #1 E. 1,2,6,9,10,20,21,22,26,27 ze up Job			
. Work Order . Job Print . Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel . Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Butt Joint Types A. Closed single flanged B. Open single flanged C. Closed double flanged D. Open double flanged E. Closed upset flanged F. Open upset flanged G. Closed square H. Open square I. Closed single-V J. Open single-V K. Closed double-V L. Open double-V M. Closed single bevel N. Open single bevel O. Closed double bevel P. Open double bevel Q. Closed single-U R. Open single-U S. Closed double-U T. Open double-U U. Strapped closed square V. Strapped open square W. Strapped closed single-V X. Strapped open single-V Y. Strapped closed single-U Z. Strapped open single-U 2. Metal thickness A. 3/16" or less B. over 3/16" 3. Tacking 4. Fixturing	1. Respond to Work Order. 2. Position Parts.	

.itive Knowledge Generaliza- to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
ask #2 · 3, 19, 25 up Welding Station Power Source A. Transformer-Rectifier B. Motor Generator I) Electric II) Gas Drive Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Coolant Flow Cables A. Ground B. Gun Properties of Shielding Gas Types of Shielding Gas A. Argon B. Helium C. CO_2		1. Set up Station. 2. Adjust Machine.	
task #3 E. 4, 5, 7 .ting Ready To Weld Wire Electrodes A. Types B. Sizes Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves		1. Select proper type & size of wire. 2. Put on protective equipment.	

tive Knowledge Generaliza- o ALL Tasks in the Domain	Cognitive Knowledge Genera.- izable to a CLASS of Tasks	Psychomotor Sk lls Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
k #3 Cont. . Leather jackets . Leather pants . Spats . Duck sleeves . Duck jackets . Duck pants . Duck aprons - Leather aprons lean surface to be elded. . Acid etch . Grind . Brush . Sand Blast		3. Clean surface.	
sk #4 11, 12, 13, 14, 16, 23 Parts			
tarting Arc . Gun angle . Wire stickout ead formation . Too High . Too low . Too wide . Too narrow Restart . Run out of wire . Welder out of position . Part out of position lean weld . Wire brush . Hammer & chisel oot penetration	1. Full root penetration 2. Key hole effect 3. Back grinding 4. Arc Air gouging 5. Backing materials A. Metal strips B. Backup tape I) ceramic II) asbestos C. copper D. Fireclay E. Plastic 6. Testing methods after backgrinding A. Spot check B. Zyglo	1. Pull trigger to start wire 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Ship spatter with chisel.	1. Weld Butt Joint. 2. Apply backing material. 3. Back grind weld. 4. Back gouge weld. 5. Test back weld with dye penetrant.

.tive Knowledge Generaliza- o ALL Tasks in the Domain	Cognitive Knowledge General- izable to a CLASS of Tasks	Psychomotor Skills Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
k #5 15, 17, 18, 24 tion & Testing			
eld troubleshooting esting emove weld defects . Grinding . Chipping . Arc air gouge . Cutting	1. Guided bent test weld strip 2. Tensile test weld specimen.		1. Run plate test. 2. Bend test strips. 3. Pull test specimens.

TASK ANALYSIS GUIDE

I. Task Statement: GMAW-Carbon Steel-Lap Joint

II. Task Performance Cues: Work Order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

	TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
		Yes	No		
1.	Is it a verbal order?	2	17		
2.	Is metal to be welded under 3/16"?	3	18		
3.	Set up GMAW equipment.			4	
4.	Select filler metal.			5	
5.	Put on welding gear.			6	
6.	Will parts be tacked?	7	19		
7.	Clean and position parts.			8	
8.	Secure parts.			9	
9.	Are parts properly aligned?	11	23		
10.	Burn into root for penetration.			12	
11.	Begin welding parts together.			10	
12.	Is proper bead contour and size forming?	13	20		
13.	Complete weld.			14	
14.	Visually inspect weld.			15	
15.	Are there excessive surface cracks?	21	16		
16.	Shut down equipment.			EOT	
17.	Read work order			2	
18.	Prepare edges for welding.			3	
19.	Position and secure parts for welding.			7	
20.	Check welding parameters.			12	
21.	Grind out cracks.			22	
22.	[illegible]			14	
23.	[illegible] for size.			9	

Domain: GMAW- Lap Joint - Carbon Steel

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
btask #1 E. 1, 2,6,8,9,17,19,23 ize up Job . Work order . Job Print . Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel . Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Lap Joint Types a) single lap b) double lap c) double strap d) single strap e) closed joggled single lap f) open joggled single lap g) flanged single lap h) flanged closed joggled single lap i) flanged open joggled single lap j) linear slotted lap k) circular slotted lap 2. Uses a) limitation I) strength II) stresses b) edged preparation c) economy 3. Metal thickness A) leaf B) flanged 4. Tacking 5. Fixturing	1. Respond to Work Order. 2. Position Parts.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
btask #2 E. 3, 16, 20 t Up Welding Station . Power source A. Transformer-Rectifier B. Motor-Generator I) Electric II) Gas Drive . Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Shielding Gas E. Coolant Flow . Cables A. Ground B. Gun . Properties of Shielding Gas . Types of Shielding Gas A. Argon B. Heli C. CO_2		1. Set up Station. 2. Adjust Machine.	
ubtask #3 . E. 4, 5, 7, 18 etting Ready To Weld . Wire Electrodes A. Types B. Sizes . Protective equipment A. Welding helmet B. Safety glasses C. Welding g.oves D. Long sleeved shirt E. Leather high top boots		1. Select proper type & size of wire. 2. Put on protective equipment.	Align parts for welding joint.

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
btask #3 (Cont.) Protective Equipment (Cont.) F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons . Clean surface to be welded A. Acid etch B. Grind C. Brush D. Sand blast		3. Clean surface.	
ubtask #4 . E. 10, 11, 12, 13, 22 eld Parts . Starting Arc A. Gun angle B. Wire stickout . Bead formation A. Too high B. Too low C. Too wide D. Too Narrow . Restart A. Run out of wire B. Welder out of position C. Part out of position . Clean weld A. Wire Brush B. Hammer & chisel . Root penetration		1. Pull trigger to start wire. 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Chip spatter with chisel.	Weld Joint.

...itive Knowledge Generaliza-...a to ALL Tasks in the Domain	Cognitive Knowledge Generali-...izable to a CLASS of Tasks	Psychomotor Skills Transferra-...ble to ALL Tasks in the Domain	Psychomotor Skills Transfer-...rable to a CLASS of Tasks
...btask #5 ...E. 14, 15, 21 ...spection and Testing . Weld troubleshooting . Testing . Remove weld defects A. Grinding B. Chipping C. Arc Air Gouge D. Cutting			

TASK ANALYSIS GUIDE

I. Task Statement: FCAW-CARBON STEEL-LAP JOINT

II. Task Performance Cues: Work Order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	18		
2. Is metal to be welded under 3/16"?	3	19		
3. Set up FCAW equipment.			4	
4. Select filler metal.			5	
5. Put on welding gear.			6	
6. Will parts be tacked?	7	20		
7. Clean and position parts.			8	
8. Secure parts.			9	
9. Are parts properly aligned?	11	24		
10. Burn into root for penetration.			12	
11. Begin welding parts together.			10	
12. Is proper bead contour and size forming?	13	21		
13. Complete weld.			14	
14. Chip slag from weld.			15	
15. Visually inspect weld.			16	
16. Are ther excessive surface cracks?	22	17		
17. Shut down equipment.			EOT	
18. Read work order.			2	
19. Prepare edges for welding.			3	
20. Position and secure part for welding.			7	
21. Check welding parameters.			12	
22. [illegible]			23	
23. [illegible]			15	
24. Realign parts for fitup.			9	

Domain: FCAW - Lap Joint - Carbon Steel

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #1 I. E. 1,2,6,8,9,18,20,24 Size up Job 1. Work order 2. Job Print 3. Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel 4. Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Lap Joint Types a) single lap b) double lap c) double strap d) single strap e) closed joggled single lap f) open joggled single lap g) flanged single lap h) flanged closed joggled single lap i) flanged open joggled single lap j) linear slotted lap k) circular slotted lap 2. Uses a) limitation I) strength II) stresses b) edged preparation c) economy 3. Metal thickness A) leaf B) flanged 4. Tacking 5. Fixturing	1. Respond to Work Order. 2. Position Parts.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #2 T. E. 3, 17, 21 Set Up Welding Station 1. Power source A. Transformer-Rectifier B. Motor-Generator I) Electric II) Gas Drive 2. Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Shielding Gas E. Coolant Flow 3. Cables A. Ground B. Gun 4. Properties of Shielding Gas 5. Types of Shielding Gas A. Argon B. Helium C. CO_2		1. Set up Station. 2. Adjust Machine.	
Subtask #3 T. E. 4, 5, 7, 19 Getting Ready To Weld 1. Wire Electrodes A. Types B. Sizes 2. Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots		1. Select proper type & size of wire. 2. Put on protective equipment.	Align parts for welding joint

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #3 (Cont.) .. Protective Equipment (Cont.) F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons 3. Clean surface to be welded A. Acid etch B. Grind C. Brush D. Sand blast		3. Clean surface.	
Subtask #4 T. E. 10, 11, 13, 14, 23 Weld Parts 1. Starting Arc A. Gun angle B. Wire stickout 2. Bead formation A. Too high B. Too low C. Too wide D. Too Narrow 3. Restart A. Run out of wire B. Welder out of position C. Part out of position 4. Clean weld A. Wire Brush B. Hammer & chisel 5. Root penetration		1. Pull trigger to start wire. 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Chip spatter with chisel.	Weld Joint.

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #5 T. E. 15, 16, 22 Inspection and Testing 1. Weld troubleshooting 2. Testing 3. Remove weld defects A. Grinding B. Chipping C. Arc Air Gouge D. Cutting			

TASK ANALYSIS GUIDE

I. Task Statement: G.M.A.W. Plugholes Mild Steel

II. Task Performance Cues: Work Order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aid
	Yes	No		
1. Is it a verbal order?	2	11		
2. Is metal to welded under 3/16"?	8	3		
3. Set up GMAW equipment.			4	
4. Select filler metal.			5	
5. Put on welding gear.			6	
6. Begin plugging holes.			7	
7. Is weld defective?	12	9		
8. Place backing plate under hole			3	
9. Will surface need to be ground after welding?	10	14		
10. Grind surface.			14	
11. Read job print.			2	
12. Check welding parameters.			13	
13. Correct weld defects.			7	
14. Shut down equipment.			EOT	

Domain: GMAW - PLUG HOLES - Carbon Steel

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #1 T.E. 1, 2, 8, 11 Size up Job 1. Work Order 2. Job Print 3. Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel 4. Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Backing material A. Copper B. Ceramic C. Metal	1. Respond To Work Order. 2. Position Parts.	Place backing in proper place.
Subtask #2 T. E. 3, 12, 14 Set Up Welding Station 1. Power Source A. Transformer-Rectifier B. Motor-Generator I) Electric II) Gas Drive 2. Controls A. Amperage-Wire Speed B. Voltage C. Inductance D. Shielding Gas E. Coolant Flow 3. Cables A. Ground B. Gun		1. Set up Station. 2. Adjust Machine.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #2 (Cont.) 4. Properties of Shielding Gas 5. Types of Shielding Gas A. Argon B. Helium C. CO_2			
Subtask #3 T. E. 4, 5, 9, 10 Getting Ready To Weld 1. Wire Electrodes A. Types B. Sizes 2. Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons 3. Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand blast		1. Select proper type & size of wire. 2. Put on protective equipment. 3. Clean surface.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Subtask #4 T. E. 6 Weld Parts 1. Starting Arc A. Gun angle B. Wire stickout 2. Bead formation A. Too high B. Too low C. Too wide D. Too Narrow 3. Restart A. Run out of wire B. Welder out of position C. Part out of position 4. Clean Weld A. Wire brush B. Hammer & chisel 5. Root penetration		1. Pull trigger to start wire. 2. Maintain proper bead formation. 3. Replace empty wire spool. 4. Reposition part for welding. 5. Wire brush weld. 6. Ship spatter with chisel.	
Subtask #5 T. E. 7, 13 Inspection and Testing 1. Weld troubleshooting 2. Testing 3. Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting			

NAME _____

DRT #J1.1

INFORMATION SHEET

Attached is a blueprint of a workpiece to be welded. Secure the workpiece from your instructor and provide the following information.

Information to be Supplied	Response
1. Type of material to be used.	
2. What was the performance cue to do this test?	
3. List the different types of joints to be used.	
4. List the different processes used.	
5. How many positions will be used?	
6. What are the different positions used?	
7. What thickness of mat'l will be used?	
8. What width are the V-groove openings?	
9. What is the total thickness of the end plates?	
10. What type of welding machine was used?	
11. What are the end plate dimensions?	
12. Will hole #20 need to be welded from both sides for complete fill?	
13. Is a backing plate needed?	

DRT #J1.2

CHECK SHEET

A	U	CRITERIA
		1. Machine is set on proper wire speed feed.
		2. Shielding gas is properly set.
		3. Welding station is set up properly.
		4. All parts are right size for the unit.
		5. Unit is tacked together according to the print.
		6. All welding is done in position specified.
		7. Proper bead contour is being maintained.
		8. No undercut appears on any of the welds.
		9. Pressure unit will hold air.
		10. All FCAW welds are free of slag.
		11. The hole is properly plugged and ground smooth.

A--Acceptable
U--Unacceptable

	Joint #	Position	Process
1.	Tee	3F	GMAW
2.	Lap	2F	GMAW
3.	Corner	1F	GMAW
4.	Butt V-Groove	4G	GMAW
5.	Corner	1F	FCAW
6.	Lap	2F	FCAW
7.	Tee	3F	FCAW
8.	Butt V-Groove	1G	FCAW
9.	Tee	2F	FCAW
10.	Tee	2F	FCAW
11.	Tee	4F	FCAW
12.	Tee	2F	FCAW
13.	Tee	3F	GMAW
14.	Tee	2F	GMAW
15.	Tee	4F	GMAW
16.	Tee	2F	GMAW
17.	Coupling	2F	GMAW
18.	Edge	1G	FCAW
19.	Edge	2G	GMAW
20.	Plug Hole	Flat	GMAW

Domain: S.M.A.W. Carbon Steel

1. S.M.A.W. Carbon Steel, Plug Holes
2. S.M.A.W. Carbon Steel, Hard Surface
3. S.M.A.W. Carbon Steel, Build up Worn Surface
4. S.M.A.W. Carbon Steel, Butt Joint
5. S.M.A.W. Carbon Steel, Lap Joint
6. S.M.A.W. Carbon Steel, Edge Joint
7. S.M.A.W. Carbon Steel, Tee Joint
8. S.M.A.W. Carbon Steel, Corner Joint

Content Limits Data Sheet A

Shielded Metal Arc Welding (SMAW) Carbon Steel Domain

Section 1: EDGE JOINT

Metal thickness
- a. 3/16" or less
- b. 3/16" or more

Aligning
- a. tacking
- b. fixturing
  - a) clamping
  - b) positioners
  - c) vise

Types of Edge Joints
- a. leaf
- b. flanged

Section 2: BUTT JOINT

A. Types of Joints
- a) closed single flanged
- b) open single flanged
- c) closed double flanged
- d) open double flanged
- e) closed upset
- f) open upset
- g) closed square
- h) open square
- i) closed single-V
- j) open single-V
- k) closed double-V
- l) open double-V
- m) closed single bevel
- n) open single bevel
- o) closed double bevel
- p) open double bevel
- q) closed single-U
- r) open single-U
- s) closed double-U
- t) open double-U
- u) strapped closed square
- v) strapped open spuare
- w) strapped closed single-V
- x) strapped open single-V
- y) strapped closed single-U
- z) strapped open single-U

B. Penetration
- a) full
- b) none

Section 2: BUTT JOINT (CONT.)

C. Key hole effect
   a) proper root opening
   b) proper electrode speed
   c) proper arc length

D. Back Grinding

E. Back Gouging

F. Backing Materials
   a) metal strips
   b) back tape
      I) ceramic
      II) asbestos
   c) copper
   d) fireclay
   e) plastic

G. Testing Methods After Back Grinding
   a) spot check (dye penetrant)
   b) zyglo

H. Butt Joint Tests
   a) guided bend test (face & root bends)
   b) tensile test
   c) side bend test
   d) free bend tests

Section 3: LAP JOINT

A. Lap joint types
   a) single lap
   b) double lap
   c) double strap
   d) single strap
   e) closed joggled single
   f) open joggled single
   g) flanged single
   h) flanged closed joggled single
   i) flanged open joggled single
   j) linear slotted
   k) circular slotted

Section 4: TEE JOINT

A. Tee joint types
   a) closed square
   b) open square
   c) closed single bevel
   d) open single bevel
   e) closed double bevel
   f) open double bevel
   g) closed single-J

Section 4: TEE JOINT (CONT.)

h) open single-J
i) closed double-J
j) open double-J

B. Welds used
a) fillet
b) multipass

C. Fillet weld parts
a) face
b) throat
c) leg
d) toe
e) root
f) root penetration

D. Fillet weld defects
a) insufficient throat
b) excessive convexity
c) undercut
d) overlap
e) insufficient leg
f) poor penetration fusion

Section 5: CORNER JOINT

1. Corner Joint Types
a) closed lapped
b) open lapped
c) closed
d) open

Section 6: HARDSURFACE

1. Properties
A) Hardness
I) Gross hardness (macro hardness)
II) Microhardness
III) Hot hardness
IV) Creep resistance
B) Abrasion Resistance
I) Under low stress
II) Under high stress
C) Impact Resistance
I) Resistance to plastic deformation under repeated impact load
II) Resistance to cracking under impact load
D) Heat Resistance
I) Resistance to tempering
II) Retention of strength when hot
III) Creep resistance
IV) Oxidation or resistance to corrosion by hot gases
V) Resistance to thermal fatigue
E) Corrosion Resistance

Section 6: HARDSURFACE (CONT.)

F) Frictional Properties and Galling Tendencies
I) Friction coefficients
II) Galling tendency
III) Surface films
IV) Lubricity
V) Platicity

2. Advantages
A) Additional resistance to wear or corrosion exactly where it is needed.
B) Easy use of very hard, wear-resistant alloys.
C) Ready application in the field.
D) Economical use of expensive alloys.
E) A hard surface layer to resist wear, supported by a tough substrate to carry the load.

Section 7: BUILD-UP

1. Puropses
A) Alter dimensions
B) Restore dimensions

Section 8: PLUG HOLES

1. Backing material
A) Copper
B) Ceramic
C) Metal

Content Limits Data Sheet B

Shielded Metal Arc Welding (SMAW) Carbon Steel Domain

Section 1: CARBON STEEL

a) high carbon
b) medium carbon
c) low carbon
d) tool steel

Section 2: POWER SOURCES

a) R C motor generator
b) transformer
c) transformer rectifier
d) rectifier
e) gas drive generator

Section 3: CONTROLS

a) ampherage
b) voltage
c) plarity
d) A/C-D/C current switch

Section 4: CABLES

a) ground
b) electrode

Section 5: CLAMP

a) ground
b) electrode

Section 6: FILLER METAL

a) electrode identification
   6010 6013 7024
   6011 7014
   6012 7018
b) electrode size
   1/16" 7/32"
   3/32" 1/4"
   1/8"
   5/32"
   3/16"

Section 7: PROTECTIVE EQUIPMENT

a) welding helment
b) safety glasses
c) welding gloves
d) long sleeved shirt

Section 7: PROTECTIVE EQUIPMENT (CONT.)

e) high top leather workboots
f) leather sleeves
g) leather jacket
h) leather pants
i) leather spats
j) leather apron
k) duck sleeves
l) duck jacket
m) duck pants
n) duck spats
o) duck apron

Section 8: CLEAN SURFACE FOR WELD

a) Acid etch b) Grind c) Brush d) Sandblast

Section 9: STRIKING AN ARC

a) tapping
b) scratching

Section 10: RESTART

a) run out of rod
b) welder out of position
c) part out of position

Section 11: CHIP SLAG

a) chipping hammer
b) air chipper
c) electric chipper

Section 12: TESTING

NDT
DT

Section 13: REMOVE DEFECTS

a) grinding
b) chipping
c) arc air
d) gouge
e) cutting

Section 14: POSITIONS

a) flat
b) horizontal
c) vertical
d) overhead

TASK ANALYSIS GUIDE

I. Task Statement: SMAW plug holes carbon steel.

II. Task Performance Cues: Work order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	12		
2. Is metal to be welded under 3/16"?	8	3		
3. Set up SMAW equipment			4	
4. Select filler metal			5	
5. Put on welding gear			6	
6. Begin plugging holes			14	
7. Is weld defective?	13	9		
8. Place backing plate under hole			3	
9. Will surface need to be ground after welding?	10	11		
10. Grind surface			11	
11. Shut down equipment			EOT	
12. Read job print			2	
13. Check welding parameters			15	
14. Chip slag			7	
15. Correct weld defects			7	

TASK ANALYSIS GUIDE

I. Task Statement: SMAW hard surface carbon steel.

II. Task Performance Cues: Work order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	9		
2. Will surface be only one layer thick?	3	13		
3. Set up SMAW equipment			4	
4. Select filler metal			5	
5. Put on welding gear			6	
6. Begin surfacing area			10	
7. Are welds proper size & contour?	12	11		
8. Shut down equipment			EOT	
9. Read job print			2	
10. Chip slag			7	
11. Check welding parameters			14	
12. Clean welded surface			8	
13. Use cross hatch welding pattern			3	
14. Correct weld defect			7	

TASK ANALYSIS GUIDE

I. Task Statement: Build up worn surface to size on steel with SMAW.

II. Task Performance Cues: Work order.

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	13		
2. Prepare surface for welding			3	
3. Set up SMAW equipment			4	
4. Select filler metal			5	
5. Put on welding gear			6	
6. Begin buildup process			7	
7. Are welds proper size & contour?	8	12		
8. Will surface need to be ground when finished?	14	9		
9. Chip slag from weld			10	
10. Clean welded surface			11	
11. Shut down equipment			EOT	
12. Check welding parameters			15	
13. Read job print			2	
14. Grind surface			11	
15. Correct weld defect			7	

TASK ANALYSIS GUIDE

I. Task Statement: SMAW, C.S., Butt Joint

II. Task Performance Cues: Work order.

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is is a verbal order?	2	20		
2. Is metal to be welded under 3?16"?	3	21		
3. Set up SMAW Equipment			4	
4. Select filler metal			5	
5. Put on welding gear			6	
6. Will parts be tacked?	7	22		
7. Clean & position parts			8	
8. Secure parts			9	
9. Are parts properly aligned?	10	26		
10. Will backing strip be used?	27	11		
11. Begin welding parts together			12	
12. Burn into root for complete penetration.			13	
13. Key hole the puddle			14	
14. Is proper bead contour & size forming?	15	23		
15. Complete the weld			16	
16. Chip slag from weld			17	
17. Visually inspect weld			18	
18. Are there excessive surface cracks?	24	19		
19. Shut down equipment			EOT	
20. Read work order			2	
21. Prepare metal for welding			3	
22. Position and secure parts for welding			7	
23. Check welding parameters			14	
24. Grind out cracks			25	
25. Reweld			16	
26. Realign parts for welding			9	
27. Place backing strip in proper place			11	

TASK ANALYSIS GUIDE

I. Task Statement: **Lap Joint**

II. Task Performance Cues: Work order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	18		
2. Is metal to be welded under 3/16"?	3	19		
3. Set up SMAW Equipment			4	
4. Select filler metal			5	
5. Put on welding gear			6	
6. Will parts be tacked?	7	20		
7. Clean & position parts			8	
8. Secure parts			9	
9. Are parts properly aligned?	11	24		
10. Burn into root for penetration			12	
11. Begin welding parts together			10	
12. Is proper bead contour & size forming?	13	21		
13. Complete weld			14	
14. Chip slag from weld			15	
15. Visually inspect weld			16	
16. Are there excessive surface cracks?	22	17		
17. Shut down equipment			EOT	
18. Read work order			2	
19. Prepare edges for welding			3	
20. Position and secure parts for welding			7	
21. Check welding parameters			12	
22. Grind out cracks			23	
23. Reweld			15	
24. Realign parts for fitup			9	

TASK ANALYSIS GUIDE

I. Task Statement: SMAW, C.S. Edge Joint

II. Task Performance Cues: Work order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	18		
2. Is metal to be welded under 3/16"?	3	19		
3. Set up SMAW Equipment			4	
4. Select filler metal			5	
5. Put on welding gear			6	
6. Will parts be tacked?	7	20		
7. Clean & position parts			8	
8. Secure parts			9	
9. Are parts properly aligned?	11	24		
10. Burn into root for penetration			12	
11. Begin welding parts together			10	
12. Is proper bead contour & size forming?	13	21		
13. Complete weld			14	
14. Chip slag from weld			15	
15. Visually inspect weld			16	
16. Are there excessive surface cracks?	22	17		
17. Shut down equipment			EOT	
18. Read work order			2	
19. Prepare edges for welding			3	
20. Position and secure parts for welding			7	
21. Check welding parameters			12	
22. Grind out cracks			23	
23. Reweld [illegible]			15	
24. Reposition parts for fitup			9	

TASK ANALYSIS GUIDE

I. Task Statement: SMAW, C.S., Tee Joint

II. Task Performance Cues: Work Order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	18		
2. Set up SMAW equipment			3	
3. Select filler metal			4	
4. Put on welding gear			5	
5. Will parts be tacked?	6	19		
6. Clean & position parts			7	
7. Secure parts			8	
8. Are parts properly aligned?	9	23		
9. Begin welding parts together			10	
10. Burn into root for penetration			11	
11. Is proper bead contour & size forming?	12	20		
12. Is there any undercut?	24	13		
13. Complete weld			14	
14. Chip slag from weld			15	
15. Visually inspect weld			16	
16. Are there any surface cracks?	21	17		
17. Shut down equipment			EOT	
18. Read work order			2	
19. Position and secure parts			6	
20. Check welding parameters			11	
21. Grind out cracks			22	
22. Repeat			17	
23. [illegible]			8	
24. [illegible] to fill undercut			12	

TASK ANALYSIS GUIDE

I. Task Statement: **Corner Joint**

II. Task Performance Cues: Work order

III. Task Performance Procedures:

A. When a decision must be made, indicate alternatives as "Yes-No" answers to questions.

B. List performance steps by most frequently occurring sequence.

TASK ELEMENTS	Decisions		Go To Step	Tools, References, Work Aids
	Yes	No		
1. Is it a verbal order?	2	18		
2. Is metal to be welded under 3/16"?	3	19		
3. Set up SMAW Equipment			4	
4. Select filler metal			5	
5. Put on welding gear			6	
6. Will parts be tacked?	7	20		
7. Clean & position parts			8	
8. Secure parts			9	
9. Are parts properly aligned?	11	24		
10. Burn into root for penetration			12	
11. Begin welding parts together			10	
12. Is proper bead contour & size forming?	13	21		
13. Complete weld			14	
14. Chip slag from weld			15	
15. Visually inspect weld			16	
16. Are there excessive surface cracks?	22	17		
17. Shut down equipment			EOT	
18. Read work order			2	
19. Prepare edges for welding			3	
20. Position and secure parts for welding			7	
21. Check welding parameters			12	
22. Grind out cracks			23	
23. Reweld			15	
24. Realign parts for fitup			9	

Planket #1

...l type knowledge Generaliza-...e to ALL Tasks in the Domain	Cognitive Knowled...e Generaliz-...izable to a CLASS of Tasks	Psychomotor Sk...ls Transferra-...ble to ALL Tasks in the Domain	Psychomotor Skills Transfer-...rable to a CLASS of Tasks
btask #1 E. 1, 2, 6, 8, 9, 18, 20, 24 ...ze up job . Work order W. O. . Job print J. P. . Metal A. High carbon B. Medium carbon C. Low carbon D. Tool Steel . Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Backing material A. Copper B. Ceramic C. Metal	Respond to Work Order Position Parts	Place backing in proper place.
T #2 ...et up welding station . E. 2, 17, 21 . Power source A. Motor Generator B. Transformer C. Transformer-Rectifier D. Rectifier E. Gas drive generator . Controls A. Amperage B. Voltage C. Polarity D. Current switch . Cables A. Ground B. Electrode		1. Set up machine. 2. Adjust machine.	

...ive Knowledge Generaliza-e ...o ALL Tasks in the Domain	Cognitive ...owled... ...izable to a CLASS of Tasks	Psychomo... Sk...ls Transferra-ble to ALL Tasks in the Domain	Psychomotor Skills Transfer-rable to a CLASS of Tasks
Clamp A. Ground B. Electrode			
...#3 ...E. 4, 5, 7, 19 ...tting ready to weld		Select electrode.	
... Filler metal A. Electrode identifi cation B. Electrode sizes			
... Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather hight top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons		Put on protective equipment.	
Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand Blast		Clean surface.	

...itive Knowledge Generaliza-...to ALL Tasks in the Domain	Cognitive Knowled...e Ge...-izable to a CLASS of Tas...s	...ychomoto... Sk...ills T...ansferra-ble to ALL Tasks in the Domain	Psychomotor Skills Transfer-rable to a CLASS of Tasks
#4 E. 10, 11, 12, 13, 14, 23 ...d Parts			
Striking Arc A. Tapping B. Scratching Arc length Bead formation A. Too high B. Too low C. Too wide D. Too narrow Restart A. Run out of rod B. Welder out of position C. Part out of position Clean weld A. Chipping hammer B. Air chipper Elec. chipper Root penetration		1. Strike and maintain arc. 2. Manipulate electrode to part position. Chip slag. Maintain proper bead formation. Restart.	
#5 E. 15, 16, 22			
Inspection & Testing A. Undercut B. Surface cracks C. Bead formation D. Spatter Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting		1. X-RAY welds. 2. Magna flux welds 3. Grind out weld defects. 4. Chip out weld defects. 5. Arc air gouge weld defects. 6. Cut out weld defects.	

...ive ...ledge Generaliza- ...o ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
...btask #1 E. 1, 2, 6, 7, 9, 18, 20, 24 ...ze up job . Work order W. O. . Job print J. P. . Metal A. High carbon B. Medium carbon C. Low carbon D. Tool steel . Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Properties A) Hardness B) Abrasion resistance C) Impact resistance D) Heat resistance E) Corrosion resistance F) Frictional properties - galling tendencies 2. Advantages	Respond to Work Order Position Parts	
...T #2 ...et up welding station ...E. 2, 17, 21 . Power source A. Motor Generator B. Transformer C. Rectifier E. Gas drive generator . Controls A. Amperage B. Voltage C. Polarity D. Current switch . Cables A. Ground B. Electrode		1. Set up machine. 2. Adjust machine.	

...tive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Clamp A. Ground B. Electrode			
#3 E. 4, 5, 7, 19 ting ready to weld		Select electrode.	
Filler metal A. Electrode identification B. Electrode sizes			
Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons		Put on protective equipment.	
Clean surface to be welded A. Acid etch B. Grind C. Brush D. Sand Blast		Clean surface.	

...tive Knowledge Generaliza-...o ALL Tasks in the Domain	Cognitive Knowled...e Gener... ...izable to a CLASS of Tasks	Psych...ctor Skills Transferr... ble to ALL Tasks in the Domain	Psychomotor Skills Transfer-rable to a CLASS of Tasks
#4 E. 10, 11, 12, 13, 14, 23 ...d Parts Striking Arc A. Tapping B. Scratching Arc length Bead formation A. Too high B. Too low C. Too wide D. Too narrow Restart A. Run out of rod B. Welder out of position C. Part out of position Clean weld A. Chipping hammer B. Air chipper C. Elec. Chipper Root penetration		1. Strike and maintain arc. 2. Manipulate electrode to part position. Chip slag. Maintain proper bead formation. Restart.	1. Apply surfacing material.
...#5 E. 15, 16, 22 Inspection & Testing A. Undercut B. Surface cracks C. Bead formation D. Spatter Remove weld defects A. Grinding B. Surface cracks C. Arc air gouge D. Cutting		1. X-RAY welds. 2. Magna flux welds. 3. Grind out weld defects. 4. Chip out weld defects. 5. Arc air gouge weld defects. 6. Cut out weld defects.	

...tive Knowledge Generaliza-...o ALL Tasks in the Domain	Cognitive Knowled...e General...izable to a CLASS of Tasks	Psychomotor Sk...lls T...ansferra-ble to ALL Tasks in the Domain	Psychomotor Skills Transfer-rable to a CLASS of Tasks
...task #1 E. 1, 2, 6, 8, 9, 18, 20, 24 ...e up job Work order W. O. Job print J. P. Metal A. High carbon B. Medium carbon C. Low Carbon D. Tool steel Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Purposes A) Alter dimensions B) Restor...dimensions	Respond to Wo...k Order Position Parts	
...#2 ...t up welding station E. 2, 17, 21 Power source A. Motor Generator B. Transformer C. Transformer-Rectifier D. Rectifier E. Gas drive generator Controls A. Amperage B. Voltage C. Polarity D. Current switch Cables A. Ground B. Electrode		1. Set up machine 2. Adjust machine	

...itive Knowledge Generaliza- ... to ALL Tasks in the Domain	Cognitive Knowle... Generali- izable to a CLASS of Tasks	Psychomotor Sk... Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
Clamp A. Ground B. Electrode			
# 3 tting ready to weld E. 4, 5, 6, 19		Select electrode.	1. Apply buildup material.
Filler metal A. Electrode identifi- cation B. Electrode sizes			
Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons		Put on protective equipment.	
Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand Blast		Clean surface.	

Cognitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
# 4 E. 10, 11, 12, 13, 14, 23 d Parts Striking Arc A. Tapping B. Scratching Arc length Bead formation A. Too high B. Too low C. Too wide D. Too narrow Restart A. Run out of rod B. Welder out of position C. Part out of position Clean weld A. Chipping hammer B. Air chipper C. Elec. Chipper Root penetration		1. Strike and maintain arc. 2. Manipulate electrode to part position. Chip slag. Maintain proper bead formation. Restart.	
# 5 E. 15, 16, 22 Inspection & Testing A. Undercut B. Surface cracks C. Bead formation D. Spatter Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting		1. X-RAY welds. 2. Mangna flux welds. 3. Grind out weld defects. 4. Chip out weld defects. 5. Arc air gouge weld defects. 6. Cut out weld defects.	

ıitive Knowledge Generaliza- e to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
ıbtask #1 E. 1, 2, 6, 9, 10, 20, 21 22, 26, 27 ize up job . Work order W. O. . Job print J. P. . Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel . Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Butt Joint Types A. Closed single flanged B. Open single flanged C. Closed double flanged D. Open double flanged E. Closed upset flanged F. Open upset flanged G. Closed square H. Open square I. Closed single-V J. Open single-V K. Closed double-V L. Open double-V M. Closed single bevel N. Open single bevel O. Closed double bevel P. Open double bevel Q. Closed single-U R. Open single-U S. Closed double-U T. Open double-U U. Strapped closed square V. Strapped open square W. Strapped closed single-V X. Strapped open single-V Y. Strapped closed single-U Z. Strapped open single-U	Respond to Work Order Position parts	
T #2 et up welding station E. 3, 19, [redacted] Power source A. Motor Generator B. Transformer C. Transformer-Rectifier D. Rectifier E. Gas drive generator		1. Set up machine 2. Adjust machine	

...itive Knowledge Generalize- ...e to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
...T #2 Cont. . Controls A. Amperage B. Voltage C. Polarity D. Current Switch . Cables A. Ground B. Electrode . Clamp A. Ground B. Electrode			
...T #3 ...E. 4, 5, 7 ...etting ready to weld . Filler metal A. Electrode identification B. Electrode sizes . Protective equipment A. Welding helmet B. safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons		Select electrode. Put on protective equipment.	Fit up plates to be welded for a butt joint.

...itive Knowledge Generaliza-e to ALL Tasks in the Domain	Cognitive Knowledge Generaliz-izable to a CLASS of Tasks	Psychomotor Skills Transferra-ble to ALL Tasks in the Domain	Psychomotor Skills Transfer-rable to a CLASS of Tasks
#3 Cont. Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand blast		Clean surface.	
T #4 . E. 11, 12, 13, 14, 16, 23, 25 eld Parts . Striking Arc A. Tapping B. Scratching . Arc length . Bead formation A. Too high B. Too low C. Too Wide D. Too Narrow . Restart A. Run out of rod B. Welder out of position C. Part out of position . Clean weld A. Chipping hammer B. Air chipper C. Elec. chipper . Root penetration	1. Full root penetration 2. Key hole effect 3. Back grinding 4. Arc air gouging 5. Backing materials A. Metal strips B. Backup tape I) ceramic II) asbestos C. Copper D. Fireclay E. Plastic 6. Testing methods after backgrinding A. Spot check B. Zyglo	1. Strike and maintain arc. 2. Manipulate electrode to part position. Chip slag. Maintain proper bead formation. Restart.	1. Weld Butt Joint. 2. Apply backing material. 3. Back grind weld. 4. Back gouge weld. 5. Test back weld with dye penetrant.

ıitive Knowledge Generaliza- e to ALL Tasks in the Domain	Cognitive Knowled e Genera - izable to a CLASS of Tasks	Psychomotor Sk lls Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
# 5 E. 15, 17, 18, 24			
Inspection & testing A. Undercut B. Surface cracks C. Bead formation D. Spatter	1 Guided bend test weld strip. 2 Tensile test weld specimen.	1. X-RAY welds. 2. Magna flux welds.	1. Run plate test. 2. Bend test strips. 3. Pull test specimens.
Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting		3. Grind out weld defects 4. Chip out weld defects 5. Arc air gouge weld defects 6. Cut out weld defects	

ıitive Knowledge Generaliza- to ALL Tasks in the Domain	Cognitive Knowledge Generali- izable to a CLASS of Tasks	Psychomotor Skills Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
ıbtask #1 . E. 1, 2, 6, 8, 9, 18, 20, 24 ize up job . Work order W. O. . Job print J. P. . Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel . Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Lap Joint types a) single lap b) double lap c) double strap d) single strap e) closed joggled single lap f) open joggled single lap g) flanged single lap h) flanged closed joggled single lap i) flanged open joggled single lap j) limear slotted lap k) circular slotted lap 2. Uses a) limitation I) strength II) stresses b) edge preparation c) economy	Respond to Work Order Position Parts	
T #2 et up welding station . E. 3, 17, 21 . Power source A. Motor Generator B. Transformer C. Transformer-Rectifier D. Rectifier E. Gas drive generator . Controls A. Amperage B. Voltage C. Polarity D. Current switch		1. Set up machine. 2. Adjust machine.	

ıitive Knowledge Generaliza- e to ALL Tasks in the Domain	Cognitive Knowled e Genera.- izable to a CLASS of Tasks	Psychomotor Sk lls Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
# 2 Cont. Cables A. Ground B. Electrode Clamp A. Ground B. Electrode			
#3 E. 4, 5, 7, 19 tting ready to weld		Select electrode.	Align parts for welding edge joint
Filler metal A. Electrode identification B. Electrode sizes			
Protective equipment A. Welding helmet B. Safety glasses C. Welding Gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons		Put on protective equipment.	
Clean surface to be welded A. Acid etch B. Grind C. Brush D. Sand Blast		Clean Surface.	

ıitive Knowledge Generaliza- e to ALL Tasks in the Domain	Cognitive Knowled, e Genera.- izable to a CLASS of Tasks	Psychomotor Sk. lls Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
#4 E. 10, 11, 12, 13, 14, 23 ld Parts Striking Arc A. Tapping B. Scratching Arc length Bead formation A. Too high B. Too low C. Too Wide D. Too Narrow Restart A. Run out of rod B. Welder out of position C. Part out of position Clean Weld A. Chipping hammer B. Air chipper C. Elec. chipper Root penetration		1. Strike and maintain arc. 2. Manipulate electrode to part position. Chip slag. Maintain proper bead formation. Restart.	Weld Edge Joint.
# 5 E. 15, 16, 22 Inspection & Testing A. Undercut B. Surface cracks C. Bead formation D. Spatter Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting		1. X-RAY welds. 2. Magna flux welds. 3. Grind out weld defects. 4. Ch'p out weld defects. 5. Arc air gouge weld defects. 6. Cut out weld defects.	

itive Knowledge Generaliza- to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
ask #1 . 1, 2, 6, 8, 9, 18, 20, 24 e up job		Respond to Work Order	
Work order W. O. Job print J. P. Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Edge joint types A) Leaf B) Flanged 2. Metal thickness A) 3/16" or less B) over 3/16" 3. Tacking 4. Fixturing	Position Parts	
#2 : up welding station E. 3, 17, 21			
Power source A. Motor Generator B. Transformer C. Transformer-Rectifier D. Rectifier E. Gas drive generator Controls A. Amperage B. Voltage C. Polarity D. Current switch Cables A. Ground B. Electrode		1. Set up machine 2. Adjust machine	

...ive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
Clamp A. Ground B. Electrode			
#3 E. 4, 5, 7, 19 tting ready to weld		Select electrode.	
Filler metal A. Electrode identification B. Electrode sizes			
Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons		Put on protective equipment.	
Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand Blast		Clean surface.	

nitive Knowledge Generalizable to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
# 4 E. 10, 11, 12, 13, 14, 23 ld Parts Striking Arc A. Tapping B. Scratching . Arc length . Bead formation A. Too high B. Too low C. Too wide D. Too narrow . Restart A. Run out of rod B. Welder out of position . Clean weld A. Chipping hammer B. Air chipper C. Elec. chipper . Root penetration		1. Strike and maintain arc 2. Manipulate electrode to part position Chip slag Maintain proper bead formation Restart	1. Weld Edge Joint
r #5 . E. 15, 16, 22 . Inspection & Testing A. Undercut B. Surface cracks C. Bead formation D. Spatter . Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting		1. X-RAY welds. 2. Magna flux welds. 3. Grind out weld defects. 4. Chip out weld defects. 5. Arc air gouge weld defects. 6. Cut out weld defects.	

itive Knowledge Generaliza- to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
btask #1 E. 1, 5, 7, 8, 18, 19, 23 ze up job Work order W. O. Job print J. P. . Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel . Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Tee Joint Types a) closed square b) open square c) closed single bevel d) open single bevel e) closed double bevel f) open double bevel g) closed single J h) open single J i) closed double J j) open double J 2. Welds used a) fillet b) multi-pass	Respond to Work Order Position parts	
T #2 et up welding station . E. 2, 17, 20 . Power source A. Motor Generator B. Transformer C. Transformer-Rectifier D. Rectifier E. Gas drive generator . Controls A. Amperage B. Voltage C. Polarity D. Current switch . Cables A. Ground B. Electrode .. Clamp A. Ground B. Electrode		1. Set up machine 2. Adjust machine	

nitive Knowledge Generaliza- e to ALL Tasks in the Domain	Cognitive Knowledge General- izable to a CLASS of Tasks	Psychomotor Sk lls Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
#3 E. 3, 4, 6 tting ready to weld Filler metal A. Electrode identifi- cation B. Electrode sizes Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F, Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck aprons N. Leather aprons Clean surface to be welded. A. Acid etch B. Grind C. Brush . Sand Blast		Select electrode. Put on protective equipment. Clean surface.	Align parts for welding Tee Joint
T #4 E. 9, 10, 11, 13, 14, 22, 24 ld Parts Striking Arc A. Tapping B. Scratching		1. Strike and maintain arc. 2. Manipulate electrode to part position.	

itive Knowledge Generaliza- to ALL Tasks in the Domain	Cognitive Knowledge Generali- izable to a CLASS of Tasks	Psychomotor Skills Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
#4 Cont. Arc length Bead formation A. Too high B. Too low C. Too Wide D. Too Narrow Restart A. Run out of rod B. Welder out of position C. Part out of position Clean weld A. Chipping hammer B. Air chipper C. Elec. chipper Root penetration		Chip slag. Maintain proper bead formation. Restart.	Weld Tee Joint
T # 5 E. 12, I5, 16, 21 Inspection & Testing A. Undercut B. Sruface cracks C. Bead formation D. Spatter Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting	1. Fillet weld parts a) face b) throat c) leg d) toe e) root f) root penetration 2. Fellet weld defects a) insufficient throat b) excessive convexity c) undercut d) overlap e) insufficient leg f) poor penetration & fusion	1. X-RAY welds. 2. Magna flux welds. 3. Grind out weld defects. 4. Chip out weld defects. 5. Arc air gouge weld defects 6. Cut out weld defects.	Correct weld defects.

ıitive Knowledge Generaliza- to ALL Tasks in the Domain	Cognitive Knowledge Generali- izable to a CLASS of Tasks	Psychomotor Skills Transferra- ble to ALL Tasks in the Domain	Psychomotor Skills Transfer- rable to a CLASS of Tasks
task #1 E. 1, 2, 6, 8, 9, 18, 20, 24 :e up job Work order W. O. Job print J. P. Metal A. High Carbon B. Medium Carbon C. Low Carbon D. Tool Steel Positions A. Flat B. Horizontal C. Vertical D. Overhead	1. Corner Joint Types a) closed lapped b) open lapped c) closed d) open	Respond to Work Order Position parts	
: #2 :t up welding station E. 3, 17, 21 Power source A. Motor generator B. Transformer C. Transformer-Rectifier D. Rectifier E. Gas drive generator Controls A. Amperage B. Voltage C. Polarity D. Current switch Cables A. Ground B. Electrode		1. Set up machine. 2. Adjust machine.	

...itive Knowledge Generaliza- ... to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
#2 Cont. Clamp A. Ground B. Electrode			
#3 E. 4, 5, 7, 19 etting ready to weld Filler metal A. Electrode identification B. Electrode sizes Protective equipment A. Welding helmet B. Safety glasses C. Welding gloves D. Long sleeved shirt E. Leather high top boots F. Leather sleeves G. Leather jackets H. Leather pants I. Spats J. Duck sleeves K. Duck jackets L. Duck pants M. Duck aprons N. Leather aprons Clean surface to be welded. A. Acid etch B. Grind C. Brush D. Sand Blast		Select electrode. Put on protective equipment. Clean surface.	Align parts for corner joint.

ıitive Knowledge Generaliza- to ALL Tasks in the Domain	Cognitive Knowledge Generalizable to a CLASS of Tasks	Psychomotor Skills Transferrable to ALL Tasks in the Domain	Psychomotor Skills Transferrable to a CLASS of Tasks
#4 E. 10, 11, 12, 13, 14, 23 ld Parts Striking Arc A. Tapping B. Scratching Arc length Bead formation A. Too high B. Too low C. Too Wide D. Too Narrow Restart A. Run out of rod B. Welder out of position C. Part out of position Clean weld A. Chipping hammer B. Air chipper C. Elec. chipper Root penetration		1. Strike and maintain arc. 2. Manipulate electrode to part position. Chip slag. Maintain proper bead formation. Restart.	1. Weld Corner Joint.
T #5 E. 15, 16, 22 Inspection & testing A. Undercut B. Sruface cracks C. Bead formation D. Statter Remove weld defects A. Grinding B. Chipping C. Arc air gouge D. Cutting		1. X-RAY welds. 2. Magna flux welds. 3. Grind out weld defects. 4. Chip out weld defects. 5. Arc air gouge weld defects 6. Cut out weld defects.	

NAME _____

DRT #J2.1

INFORMATION SHEET

Attached is a blueprint of a workpiece to be welded. Secure the workpiece from your instructor and provide the following information.

Information to be Supplied	Response
1. Type of workpiece material.	
2. Size of workpiece material.	
3. What positions are the holes to be plugged in?	
4. How many build up layers are added to the piece?	
5. What electrode is used to plug the holes?	
6. Will a backing plate be used to plug the holes? Why?	
7. What electrode will be used to build up the surface?	
8. How many layers of hardface material is used?	
9. What electrode is used?	
10. Will the plate be ground after plugging the holes?	
11. What kind of welder was used to perform these tasks?	

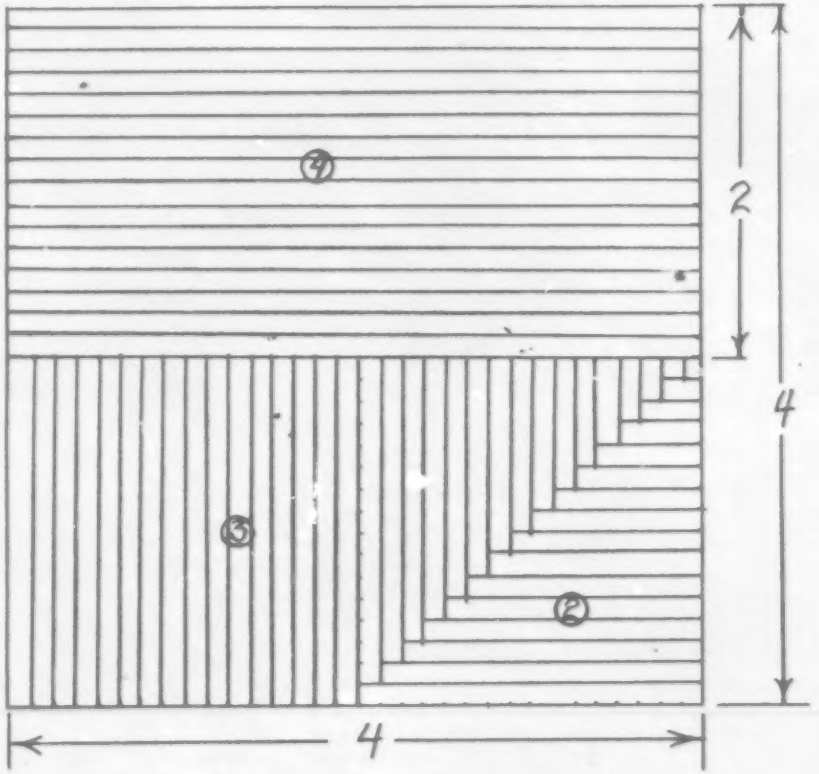
DRT #J2.2

CHECK SHEET

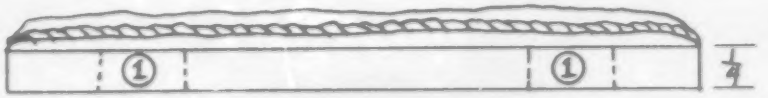
A	U	CRITERIA
		1. Plugged holes were ground smooth.
		2. No crater are evident from holes.
		3. Surfaced area is smooth and even.
		4. Hardface material is smooth.

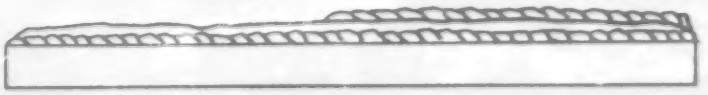
A--Acceptable
U--Unacceptable

BUILDUP PAD
SCALE - FULL
DRT # 2



1. PLUG 2 ½" HOLES WITH ⅛" 6010 FLAT AND HORIZONTAL
2. BUILDUP SURFACE WITH LAYER OF ⅛" 70S-6
3. SAME AS "2"
4. HARDFACE SURFACE WITH ⅛" 308





FINANCIAL STATEMENT FOR FINAL REPORT ENDING June 30, 1981
(Date)

Project No. 20-80-III-3

ITEMS	Project Budget FY 19--		Total Expenditures on Project		End of Project Balance	
	Agency	Federal	Agency	State/ Federal	Agency	State/ Federal
A. DIRECT EXPENDITURES						
1. Personnel	-	$4,000.00	-	$3,983.28		$16.72
2. Contractual services						
3. Employee benefits						
4. Travel						
5. Supplies and materials	$400.00	-	$358.00	-	$42.00	-
6. Communications (include phone call, printing)						
7. Properties (rentals or purchase of equipment)	$500.00	-	$500.00	-	-	-
8. Facilities						
9. Product production and dissemination						
10. Project Evaluation						
B. INDIRECT EXPENDITURES						
C. TOTAL EXPENDITURES	$900.00		$858.00	$3,983.28	$42.00	$16.72 *

Fiscal Agent/Director: Nick Banos, Jr.

Institution/Agency Name: Blue River Vocational Center

*Refund this amount to the State Board of Vocational and Technical Education

FINANCIAL STATEMENT FOR FINAL REPORT ENDING June 30, 1981
(Date)

Project No. 28-80-III-3

ITEMS	Project Budget FY 19--		Total Expenditures on Project		End of Project Balance	
	Agency	Federal	Agency	State/ Federal	Agency	State/ Federal
A. DIRECT EXPENDITURES						
1. Personnel	-	$2,000.00		$1,955.12	-	$ 44.88
2. Contractual services	$ 800.00	-	$ 800.00	-	-	-
3. Employee benefits	50.00	140.00	50.00	3.09	-	136.91
4. Travel	100.00	100.00	100.00	16.40	-	83.60
5. Supplies and materials	1,300.00	-	1,300.00	-	-	-
6. Communications (include phone call, printing)	150.00	-	23.78	-	126.22	-
7. Properties (rentals or purchase of equipment)	2,000.00	-	2,000.00	-	-	-
8. Facilities	1,000.00	-	1,000.00	-	-	-
9. Product production and dissemination	200.00	-	200.00	-	-	-
10. Project Evaluation		184.00	-	-	-	184.00
B. INDIRECT EXPENDITURES						
C. TOTAL EXPENDITURES	$5,600.00	$2,424.00	$5,473.78	$1,974.61	$126.22	$449.39 *

Fiscal Agent/Director: Nick Banos, Jr.

Institution/Agency Name: Blue River Vocational Center

*Refund this amount to the State Board of Vocational and Technical Education

FINAL REPORT ABSTRACT

A. The PROCESS/PRODUCT(S) to be adopted/adapted and delivered by this project are:

Two Domain Reference Tests -
Shielded Metal Arc Welding - Carbon Steel
Gas Metal Arc Welding - Carbon Steel

B. The specific OBJECTIVES of the proposal are to:

1. Develop and Implement DRT for Domain of Shielded Metal Arc Welding on Carbon Steel
2. Develop and Implement DRT for Domain of Gas Metal Arc Welding on Carbon Steel

C. The PROCEDURES for achieving these objectives are:

For Detailed Description See Section V.

D. The expected OUTCOMES for or potential IMPACTS on vocational education are: (Number each outcome to correspond with its related objective and procedure or reference by number.)

The main outcome of this whole project is a more effective delivery and testing system for teaching vocational welding.